The Detection of Forme Fruste Pellucid Degeneration (PMD) and KC prior to Refractive Surgery

Randy J. Epstein, MD
Professor, Cornea Service,
Rush Medical College, Chicago, IL

RUSH UNIVERSITY MEDICAL CENTER

Topography

- Graphical representation of a surface, indicating relative positions and elevations.

Corneal topography

- Topographic measurement of the anterior corneal surface. Corneal topography began with **videokeratography**, which improved upon keratometry by replacing a single reflective ring with a multi-ring placido and the human observer with a video imaging and computer analysis system. Extended data coverage allowed local surface curvatures to be mapped. Only axis-based curvatures (first axial and then meridional) were measured with these early instruments.

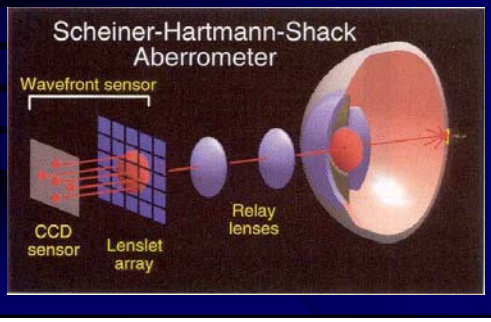
Second generation instruments

- Computed or directly measured corneal elevation and employed exact raytracing to simulate the optical effectiveness (power and aberration) of the anterior corneal surface.
- Although corneal topography purports to measure the anterior corneal surface, every instrument, excepting Orbscan, really measures the anterior surface of the pre-corneal tear film.

Anterior segment topography. *Corneal Topography*

- topographic measurement of external and internal surfaces within the anterior segment of the eye. Anterior segment topography is an extension of corneal topography to internal ocular surfaces, made possible by raytrace triangulation and embodied by Orbscan.

Wavefront analysis



Wavefront analysis to Dx Pellucid Marginal Degen.(PMD): OSN 10/04

Wavefront analysis detects pellucid marginal degeneration before LASIK

Bausch & Lomb Zywave used on patient with decreased vision and monocular diplopia in his left eye.

by Eugenio M. Candal, MD, Dianna L. Seldomridge, MD, MBA, Laura T. Muller, MD, and Randy J. Epstein, MD

Special to Ocular Surgery News

Wavefront Analysis for Keratoconus and PMD

Seldomridge, Candal, Epstein

Review of Ophthalmology
October, 2005: 96-103

Keratoconus: Maximum thinning= maximal protrusion

Pellucid Marginal Corneal Degeneration (PMD)

- Infferior thinning
- High, REGULAR against-the-rule astigmatism is most common initial manifestation
- Missed by most KC screening programs

Pellucid Marginal Degeneration: Bilateral, inferior thinning

Frequently mis-diagnosed as high astigmatism or keratoconus

Pellucid vs. Keratoconus

Area of maximal protrusion is ABOVE area of maximal thinning in PMD

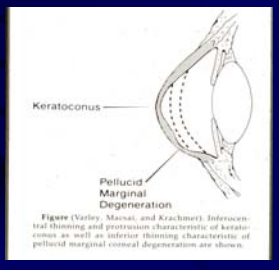
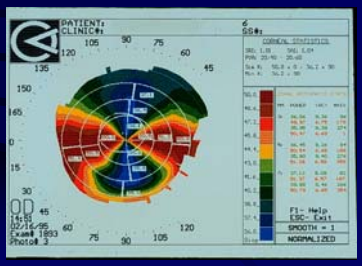


Figure (Varley, Macsai, and Krachmer). Inferocentral thinning and protrusion characteristic of keratoconus as well as inferior thinning characteristic of pellucid marginal corneal degeneration are shown.

Pellucid Marginal Degeneration: Demographics

- 20-40 years old at presentation
- Usually present with high against-the-rule astigmatism
- Contact lens intolerance
- FREQUENTLY seek out refractive surgery
- FREQUENTLY missed by refractive surgeons: High incidence in ectasia cases

Pellucid Marginal Degeneration: "Inverted horseshoe" or "crab's claw" sign on topography



Belin screening criteria for KC on Pentacam

- Anterior elevation < + 12
- Posterior float < +17

Definite unilateral PMD/?FFKC: Patient G.G.- HOA's & Pentacam

5/03: 18 y.o.c/o blurry Va OS

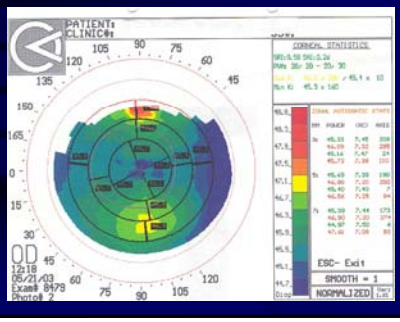
MR OD= -0.50 sph

OS= -0.75 + 1.75 x 10

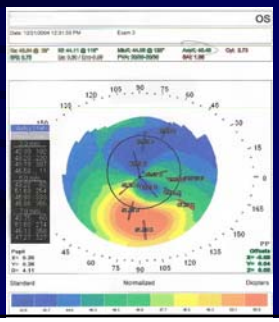
Central pachs= 0.566mm OU

No iron lines/rings

GG: TMS OD- normal



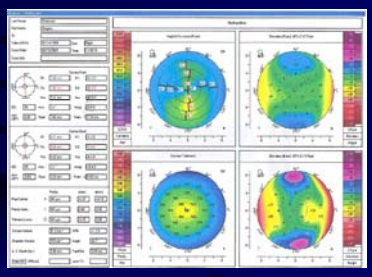
GG: Initial TMS OS- Crab's Claw



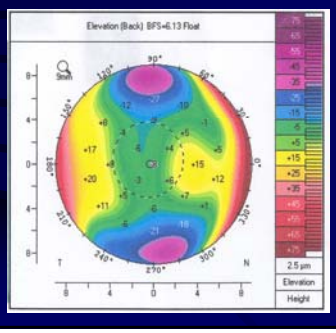
GG Zywave OD- normal

GG: Zywave OS- HOA's

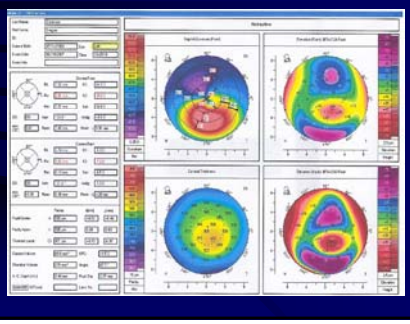
GG: Pentacam OD- normal



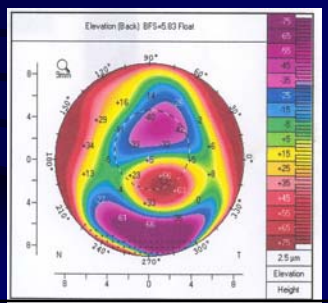
GG: Pentacam- Post OD



GG: Pentacam OS



GG: Pentacam Post- OS "FFKC" pattern



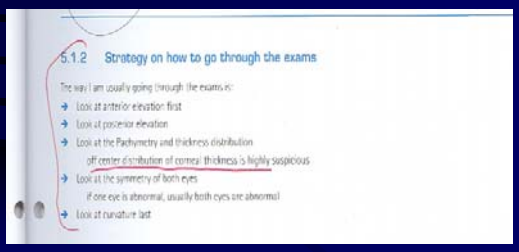
Probable Occult Pellucid Degeneration

- Refractive surgery contraindicated at present
- Surprisingly common
- Missed by topographic “keratoconus detection programs”
- Role for wavefront analysis? Not all systems are equally helpful but HOA’s suspicious
- Role for Pentacam- Synergistic with wave

Pentacam KC detection

- Graphic plot of mean corneal thickness, concentrically, as a function of diameter
- Indices: ISV, IVA, KI, CKI, Rmin, IHA, IHD

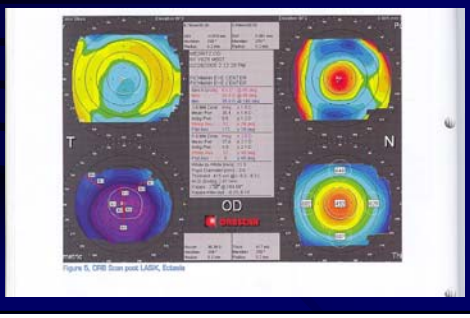
Exam Strategy


5.1.2 Strategy on how to go through the exams

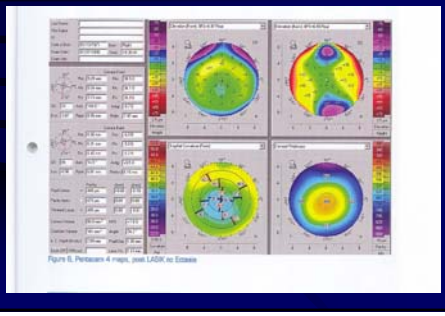
The way I am usually going through the exams is:

- Look at anterior elevation first
- Look at posterior elevation
- Look at the Pachymetry and thickness distribution
  off center distribution of corneal thickness is highly suspicious
- Look at the symmetry of both eyes
  If one eye is abnormal, usually both eyes are abnormal
- Look at curvature last

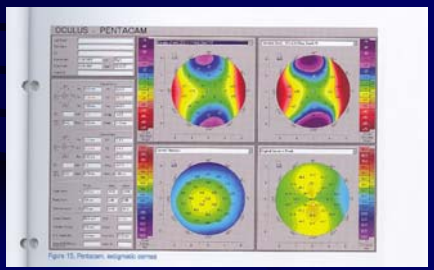
OBscan false positive post-LASIK ectasia



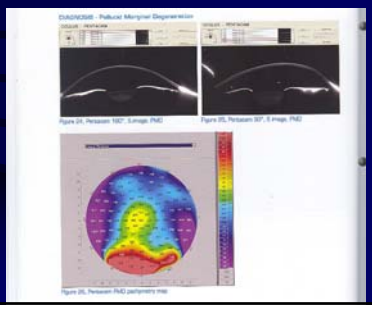
Pentacam shows no post-LASIK ectasia



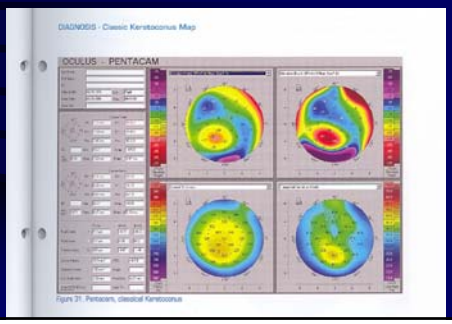
Normal astigmatic cornea



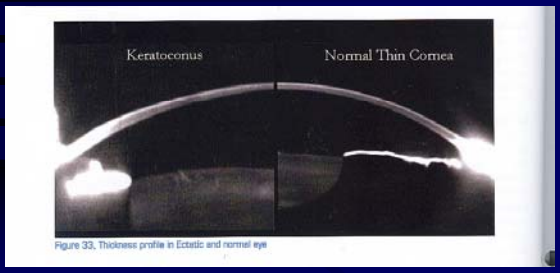
PMD : Scheimpflug photos (nl. horiz, abn. vert) and pachymetry map



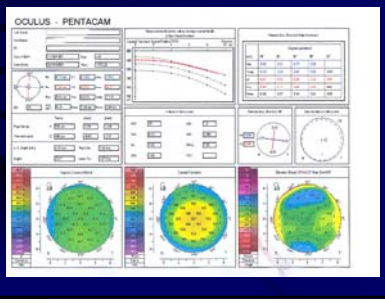
Classic Keratoconus



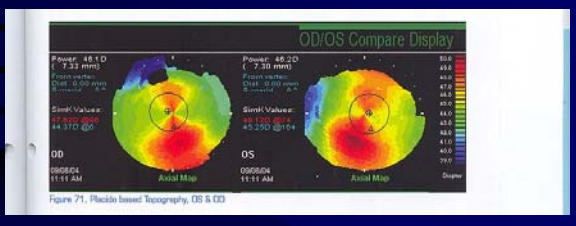
Keratoconus vs Normal Scheimpflug



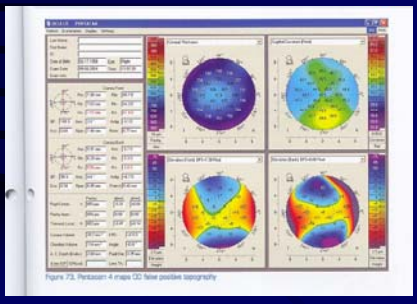
Keratoconus detection with Pentacam



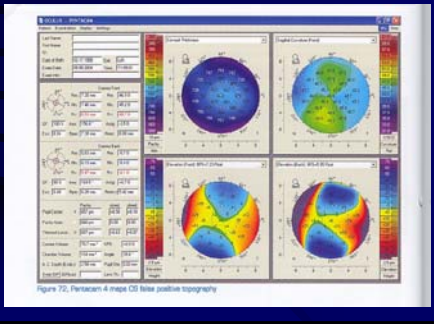
? FFKC on (axial) topography: Atypical inferior steepening



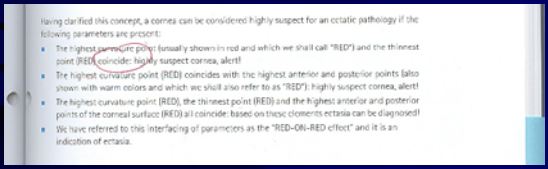
Previous case: OD= normal



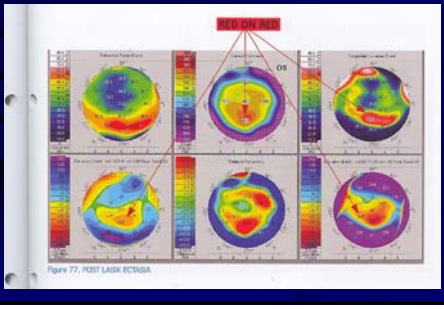
Previous case: OS= normal



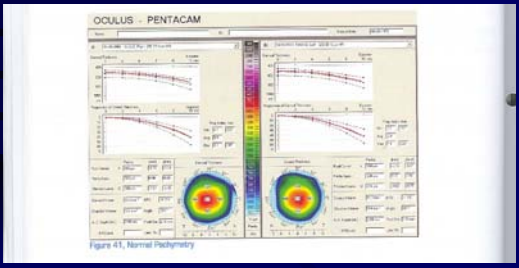
Ectasia diagnosis



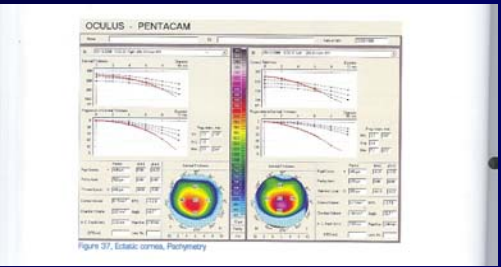
Post-LASIK ectasia: "Red on Red"



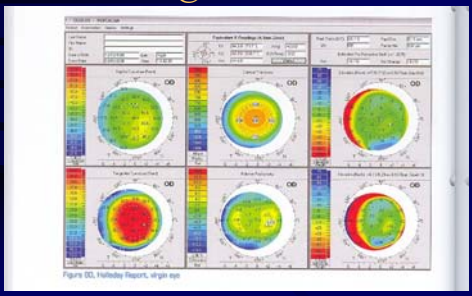
Advanced ectasia software: Normal cornea



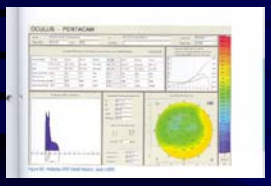
Advanced ectasia software- Curve/Pach maps show ectasia

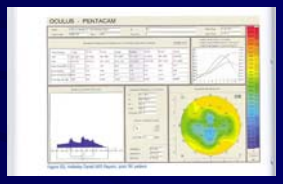


"Holladay Report" for IOL calc's EKR @ 4.5 mm o.z.



“Good” spike vs “bad” peak





Thanks for your attention!
“repstein@chicagocornea.com”